MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 3, 2017/2018

TMT 1171 – MATHEMATICAL TECHNIQUES 1

(All sections / Groups)

1 JUNE 2018
3.00 p.m. – 5.00 p.m.
(2 Hours)

INSTRUCTIONS TO STUDENT

1. This question paper consists of **3** pages, excluding the cover page, with 5 questions and an **Appendix**.
2. **Answer ALL questions.**
3. Print all your answers in the answer booklet.

Answer ALL questions.

Question 1

a) Given the points $P(1, 1, 1)$ and $Q(3, 5, 8)$, and vectors u <2, 3, 5> and v <6, 1, 4>.

i. Find the vector $\overrightarrow{PQ}$. [1 mark]
ii. Find the dot product $u \cdot v$. [1 mark]
iii. Find the cross product $u \times v$. [2 marks]

b) Find an equation for the plane through $P(1,2,5)$ that is perpendicular to the planes $3x - 2y + 5z = 2$ and $2x + 3y - z = 1$. [6 marks]

Question 2

a) Given the following matrices,

$$A = \begin{bmatrix} 2 & -1 \\ 0 & 1 \end{bmatrix} \text{ and } B = \begin{bmatrix} 5 & 8 \\ 6 & -3 \end{bmatrix}.$$

Find

i. $B + 2A$. [2 marks]
ii. $[AB]^T$. [3 marks]

b) Solve the following system of linear equations by using Cramer's Rule.

$$\begin{aligned} x + 2y - z &= 3 \\ 2x + y - 2z &= 3 \\ -3x + y + z &= -6 \end{aligned}$$

[5 marks]

Continued.....

Question 3

a) Find the eigenvalues and eigenvectors for matrix $A = \begin{bmatrix} 2 & 6 \\ 1 & 3 \end{bmatrix}$.

[5 marks]

b) Evaluate the limit, if it exists.

i. $\lim_{x \to -3} (5-x)^2$ [2 marks]

ii. $\lim_{x \to \infty} \frac{7x^3}{x^3-3x^2+6x}$ [3 marks]

Question 4

a) Find the **first** and **second** derivatives of $y = 3x^{-2} - x^{-1}$. [4 marks]

b) Differentiate

i. $y = \frac{x^2-1}{x^2+x-2}$. [3 marks]

[HINT: Simplify the function first before differentiating it.]

ii. $y = (3x^2-1)^3$ [3 marks]

Question 5

a) Use the *Fundamental Theorem of Calculus* to compute $\int_0^1 (x^3 - \cos x + 3)dx$.

[3 marks]

b) Find $\int x^3 e^{-x^4} dx$ by using *integration by substitution.* [4 marks]

c) Use *integration by part* to compute $\int 2xe^x dx$. [3 marks]

Continued.....

Appendix

- The equation of plane passes through $P(x_0, y_0, z_0)$ with a normal vector $\langle a,b,c \rangle$ is $a(x-x_0)+b(y-y_0)+c(z-z_0)=0$
- Characteristic equation: $|\lambda I - A| = 0$
- The derivative of $y = x^n$ is $y' = nx^{n-1}$, for $n \neq -1$
- $\int x^n \, dx = \frac{x^{n+1}}{n+1} + c$, for $n \neq -1$
- $\int \cos x \, dx = \sin x + c$
- $\int e^x \, dx = e^x + c$
- $\int e^{-x} \, dx = -e^{-x} + c$

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